



ARTICLE

# Iridescent Beetle Adornments Suggest Incipient Status Competition among the Earliest Horticulturalists in Bears Ears National Monument

Michael L. Terlep<sup>1</sup> , Francis E. Smiley<sup>2</sup>, and Randall Haas<sup>3</sup> 

<sup>1</sup>North Kaibab Ranger District, Kaibab National Forest, Fredonia, AZ, USA, <sup>2</sup>Department of Anthropology, Northern Arizona University, Flagstaff, AZ, USA, and <sup>3</sup>Department of Anthropology, Wayne State University, Detroit, MI, USA

**Corresponding author:** Francis E. Smiley. Email: [francis.smiley@nau.edu](mailto:francis.smiley@nau.edu)

(Received 15 February 2022; revised 24 June 2022; accepted 20 September 2022)

## Abstract

Anthropological research has long theorized that emergent food-producing economies catalyzed high levels of inequality in human societies, as evident in the earliest use of jewelry made from gold, copper, and other precious minerals among early agricultural populations. Although the US Southwest appears to have been an exception, we report the discovery of two Basketmaker II period necklaces constructed of green iridescent scarab beetle femora, which suggests a homologous association between emergent agriculture and inequality. Drawing insight from ethnography, archaeology, entomology, and evolutionary ecology, we hypothesize that these and other jewelry items of Basketmaker II culture were visually prominent, honest signals of socioeconomic capital that emerged during a period of surplus food production and incipient wealth accumulation. It appears that Basketmaker II societies—like other emergent food-producing economies around the world—grappled with the opportunities and challenges that arise with surplus production, albeit in a distinct way that involved visually striking insect and feather adornments as status signals. Archaeologists may have previously overlooked this behavior due to Western biases that privilege precious metals and minerals as prestige objects and archaeological biases that tend to view insects as food or agents of site disturbance.

## Resumen

La investigación antropológica ha teorizado durante mucho tiempo que las economías emergentes productoras de alimentos catalizaron altos niveles de desigualdad en las sociedades humanas, como se evidencia en el uso más temprano de joyas de oro, cobre y otros minerales preciosos entre las primeras poblaciones agrícolas. Aunque el suroeste de los EE. UU. parece haber sido una excepción, informamos el descubrimiento de dos collares del Período Basketmaker II elaborados con fémures de escarabajo verde iridiscente, que sugieren una asociación homóloga entre la agricultura emergente y la desigualdad. Extrayendo información de la etnografía, la arqueología, la entomología y la ecología evolutiva, planteamos la hipótesis de que estos y otros artículos de joyería de la cultura Basketmaker II fueron señales honestas y visualmente prominentes del capital socioeconómico que surgió durante un período de producción excedente de alimentos y acumulación incipiente de riqueza. Parece que las sociedades Basketmaker II, al igual que otras economías emergentes productoras de alimentos en todo el mundo, lidiaron con las oportunidades y los desafíos que surgen con la producción excedente, aunque de una manera distinta que involucraba adornos de insectos y plumas visualmente llamativos como señales de estatus. Es posible que los arqueólogos hayan pasado por alto este comportamiento anteriormente debido a los prejuicios occidentales que privilegian los metales y minerales preciosos como objetos de prestigio y los sesgos arqueológicos que tienden a ver a los insectos como alimento o agentes de perturbación del sitio.

**Keywords:** agricultural origins; inequality; costly signaling; archaeoentomology; US Southwest; Basketmaker II period

**Palabras clave:** orígenes agrícolas; desigualdad; señalización costosa; arqueoentomología; suroeste de EE. UU.; Período Basketmaker II

In this article, we report two examples of necklaces made of iridescent beetle leg segments from archaeological contexts in Bears Ears National Monument, southeastern Utah. Each artifact is made from multiple iridescent green femoral leg segments of scarab beetles (*Cotinis mutabilis*) strung on finely twined yucca fiber cordage. One of the artifacts was recovered from Boomerang Shelter (42SA24771) in 1999 during Northern Arizona University's (NAU) Colorado Plateau Agricultural Origins (CPAO) project (Figure 1). The other was confiscated as part of an Archaeological Resource Protection Act (ARPA) investigation and likely comes from Atlatl Cave, approximately 30 km north of Boomerang Shelter (Figures 2 and 3). The artifacts were recovered from deposits largely associated with early agricultural materials, suggesting an early agricultural context, locally known as the Basketmaker II period (4.0–1.5 cal ka [thousands of years ago]; Merrill et al. 2009; Smiley 1997a, 2002; Smiley and Smiley 2017; Wills 1988). To our knowledge, these are the only two examples of beetle jewelry from Basketmaker contexts, and they are two of just three examples in the US Southwest (hereafter, Southwest), with one other example known from Tularosa Cave, New Mexico (Martin et al. 1952:454).

Our analysis begins with detailed descriptions of the beetle jewelry artifacts and their respective archaeological contexts. We then present radiocarbon dates, which confirm a Basketmaker II period association. In order to understand the behavioral significance of these unusual, previously unreported Basketmaker II scarab-beetle adornments, we first summarize Basketmaker II period economy and society. We then review ethnographic and archaeological observations of insect jewelry in other cultural contexts in the Southwest and elsewhere. Finally, we explore the role of jewelry in early agricultural societies. Our comparisons lead us to propose that these showy, costly Basketmaker II jewelry artifacts served as status-signaling objects in an economic context of agricultural surplus and incipient wealth disparity. We conclude with suggestions for future research to better understand the possible



**Figure 1.** *Cotinis mutabilis* necklace fragment from Boomerang Shelter, Bears Ears National Monument: (a) whole artifact (photo by Ryan Belnap), (b) close-up view (two stitched images; image by Michael Terlep).



**Figure 2.** Photo of the *Cotinis mutabilis* necklace from Atlatl Cave in Bears Ears National Monument. (Photograph by Michael Terlep.)

roles of beetle jewelry in Basketmaker II society, and costly adornments in early farming societies more generally.

### The Boomerang Shelter Adornment

Boomerang Shelter (42Sa24771) is a large rockshelter on the east-facing aspect of Comb Ridge—a north–south-oriented sandstone monocline that extends over 120 km from northeastern Arizona to Bears Ears National Monument in southeastern Utah (Figures 4 and 5). The site contains in situ Archaic and Basketmaker II materials, despite extensive looter damage to the upper portions of cultural deposits (Smiley and Robins 2005). Seven radiocarbon samples from Boomerang Shelter range from 2.6 to 1.5 cal ka, indicative of an intensive Basketmaker II occupation (LeBlanc et al. 2007; Smiley 1997; Smiley and Robins 1997).

In its recovered state, the Boomerang Shelter beetle-jewelry artifact measures 8.8 cm long and consists of 16 iridescent green beetle femora beads strung on a piece of fine-textured plant-fiber cordage (see Figure 1). One end of the artifact was burned sometime prior to excavation. The artifact is likely a



**Figure 3.** Close-up of the Atlatl Cave necklace pendant, surrounding beads, and cordage.

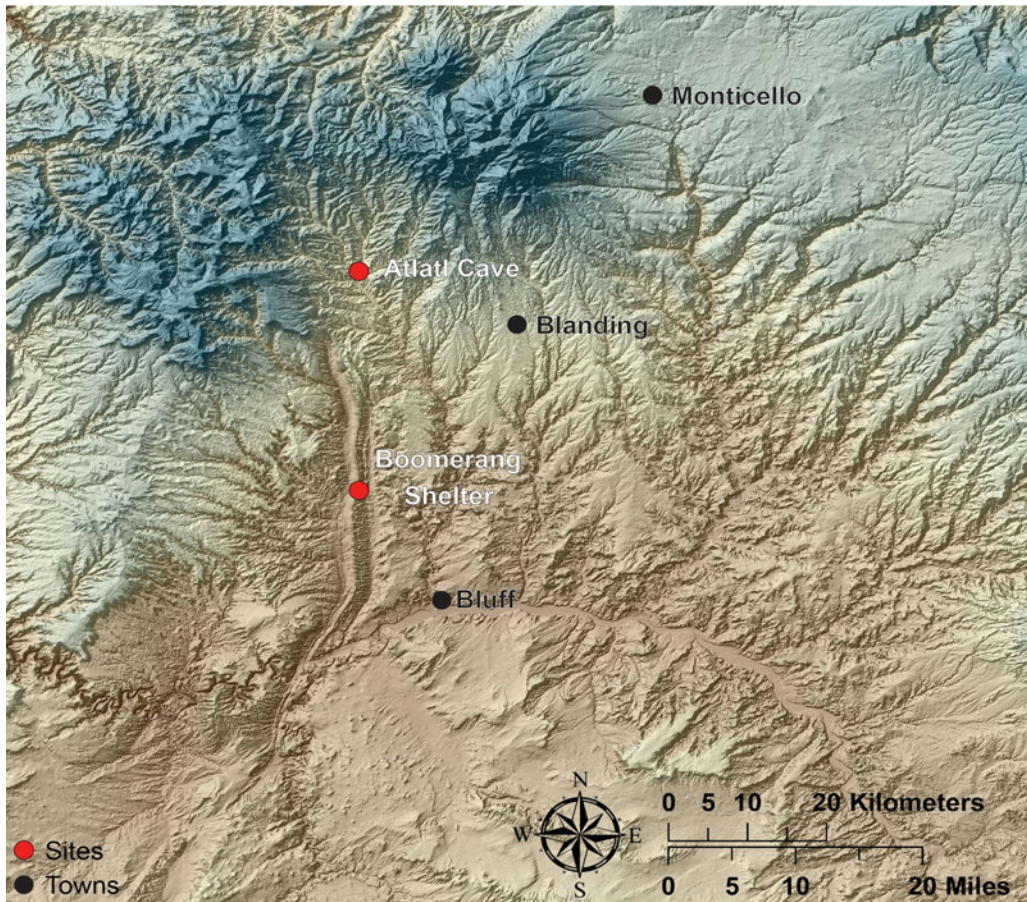


Figure 4. General locations of the Boomerang Shelter and Atlatl Cave sites.

small portion of a larger necklace or bracelet. Eleven of the *Cotinis mutabilis* beads appear positioned with the dorsal side up. No cut marks or modifications are visible along the beads, suggesting that the segments were disarticulated at the joints and strung through the naturally hollow cavity of the femora.

The cordage on which the beads are strung exhibits a 2s-Z construction, which consists of two s-spun yarns plied Z-wise (Emery 1966). The fibers are finely processed, and the cordage maintains a relatively uniform diameter of 0.9 mm. Microscopic analysis of the fibers reveals spiral xylem cells (Figure 6a), which are consistent with monocotyledonous species—likely yucca (*Yucca* spp.)—and rules out other commonly used species, such as *Apocynum* and *Asclepias* spp. Moreover, the fibers exhibit narrow lumen-to-cell wall ratios (Figure 6b), consistent with broadleaf yucca varieties (e.g., *Yucca baccata*; Bell and King 1944). Both the twist structure and fiber choice for the Boomerang Shelter artifact are consistent with Basketmaker II cordage construction from the Boomerang Shelter and other Basketmaker II cordage assemblages. They are inconsistent with the Fremont Culture and Archaic cordage that also occurs in the region, which more typically takes on a 2z-S twist structure and tends to be made from *Apocynum* spp. fibers (Haas 2001, 2006).

Although the construction and context of the artifact strongly suggests a Basketmaker II association, the disturbed nature of Boomerang Shelter leaves open the possibility that the artifact is intrusive. We therefore directly dated fragments of yucca fiber and beetle chitin from the artifact by accelerator mass spectrometry (AMS). The pooled materials returned a conventional radiocarbon age of  $2020 \pm 30$   $^{14}\text{C}$  BP (Beta-539493;  $\delta^{13}\text{C} = -16.0\text{‰}$ ), which calibrates to 2.0–1.8 cal ka (95%) using the IntCal20 Northern Hemisphere calibration curve (Reimer et al. 2020) as implemented with the Bchron

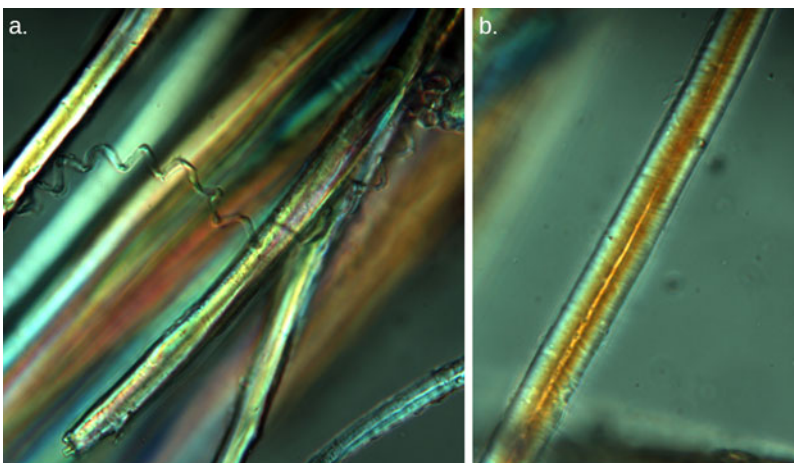


**Figure 5.** View of Boomerang Shelter from the northeast. Boomerang Shelter shields an area more than 100 m long and 20–25 m deep.

radiocarbon calibration package in R statistical computing language (Haslett and Parnell 2008; R Core Team 2022). This date confirms a Basketmaker II period association.

### The Atlatl Cave Adornment

The Atlatl Cave artifact was seized as part of an ARPA case in the vicinity of Blanding, Utah. Although the site-level provenience is uncertain, the ARPA investigation determined Atlatl Cave to be the likely source (Deborah Westfall, personal communication 2010). Similar to Boomerang Shelter, Atlatl Cave



**Figure 6.** Microscopic image of the Boomerang Shelter cordage fibers: (a) spiral xylem cell fibers, seen at the center of the image, identify the fibers as Agavaceae, which includes *Yucca* spp.; (b) the narrow lumen-to-wall ratio suggests a broadleaf yucca, such as *Yucca baccata*. (Color online)

(also known as Battle Cave) is located in a small tributary of Allen Canyon within Bears Ears National Monument, just 30 km north of Boomerang Shelter (see [Figure 4](#)).

The Atlatl Cave beetle adornment is a complete necklace consisting of three strands totaling 212 beads, and it likely incorporated an abalone shell pendent (see [Figures 2](#) and [3](#)). Although the abalone pendent has a small biconvex drilled hole, it was not affixed to the necklace at the time of seizure. The total length of the necklace is 101 cm. As with the Boomerang Shelter artifact, the beads are made from iridescent *Cotinis mutabilis* femora. Only small portions of cordage are devoid of leg-segment ornamentation. Gaps between femora likely indicate the location of missing or deteriorated segments.

The cordage of the Atlatl Cave item shows similar material use and construction to that of the Boomerang Shelter artifact. The three-strand adornment consists of finely processed fibers and relatively uniform cordage with a diameter of 0.9 mm. Microscopic examination of the fibers reveals spiral xylem cells and a narrow lumen, which is most consistent with broadleaf yucca fibers, likely *Yucca baccata* (Bell and King 1944). The 2s-Z construction and yucca fibers are consistent with Basketmaker II cordage artifacts (Haas 2001, 2006).

Although the provenience of the Atlatl Cave necklace remains somewhat tenuous, additional artifacts seized in the same ARPA case—and reportedly from the same site—suggest a Basketmaker II cultural association. Among the other artifacts recovered during the ARPA seizure were two female cordage aprons made of and decorated with human hair and yucca. The construction of the aprons is very similar to that of several other Basketmaker II yucca aprons from the Four Corners area, two of which have been AMS dated to 2.0–1.7 cal ka (Laurie Webster, personal communication 2020; Webster and Jolie, personal communication 2022). Additional dates from Atlatl Cave (aka Battle Cave), processed by the Cedar Mesa Perishables Project, span the mid-Basketmaker II period from 2.1 to 1.5 cal ka, with most in the 2.0–1.7 cal ka range (Laurie Webster, personal communication 2022). The Edge of the Cedars State Park Museum in Blanding, Utah, gained custody of the necklace and aprons in 2000.

In an effort to secure the temporal context of the Atlatl Cave necklace, we directly dated fragments of yucca fiber and beetle chitin from the artifact by AMS. The pooled materials returned a conventional radiocarbon age of  $2010 \pm 30$   $^{14}\text{C}$  BP (Beta-539493;  $\delta^{13}\text{C} = -19.4\text{‰}$ ), which calibrates to 2.0–1.8 cal ka (95%) using the IntCal20 Northern Hemisphere calibration curve (Reimer et al. 2020) as implemented with the Bchron radiocarbon calibration package in R statistical computing language (Haslett and Parnell 2008; R Core Team 2022). This date confirms a Basketmaker II period association and furthermore reveals a remarkably similar age to that of the Boomerang Shelter artifact, suggesting the possibility that the two artifacts were part of the same production system or even crafted by the same individual or community.

## Of Basketmakers and Beetles

Having secured the Boomerang Shelter and Atlatl Cave adornments in the context of Basketmaker II culture, we now examine the significance of the association. In order to formulate a hypothesis for the role of these distinct items in Basketmaker II society, we present a summary of Basketmaker II socioeconomy, the use of beetle jewelry in human societies, and the use of showy objects in early agricultural societies.

### *Basketmaker II Peoples*

Basketmaker II groups occupied the northern Southwest during the Early Agricultural period (sensu Huckell 1996; Merrill et al. 2009), when the arrival of Mesoamerican domesticates marked the transition from mobile hunter-gatherer to sedentary agricultural societies. The preceramic Basketmaker II culture spanned the northern Southwest from 4.0 to 1.5 cal ka and was marked by side- and corner-notched projectile points, use of the atlatl, an intensive fiber and adornment industry, maize agriculture, partial dependence on stored foods, the use of both sheltered and open-air living sites, inhumation burials both in sheltered and in open-air contexts, and an apparently semisedentary lifestyle (Kidder and Guernsey 1919; Smiley 2002; Wills 1988). Basketmaker II groups appear to have functioned as small, band-sized, seasonally mobile groups—much like hunter-gatherer societies. At

the same time, the groups became increasingly tied to places as farmers, who planted, tended, harvested, and stored crops—particularly maize and squash—for year-round use (Coltrain et al. 2017; Geib 2011).

Surplus crops were stored in slab-lined, subterranean storage cists. The cists, which often appear in high densities at Basketmaker sites, not only suggest heavy investment in agricultural production but also the generation of surpluses, which would have created a context for disparities in food wealth. Despite clear evidence for agricultural tethering to places on landscapes, the absence of ceramic technology and stone-masonry architecture, both of which appeared during later time periods, indicates a degree of residential mobility (Smiley 1997b, 2002). The Basketmaker II cultural phenomenon was thus transitional, albeit meta-stable (*sensu* Smith 2001), spanning the gap between fully mobile hunter-gatherer societies and sedentary farmers.

Articles of adornment from the Basketmaker II period include bone, marine shell, and stone pendants; seed, bone, shell, and stone beads; and feather-decorated hair combs (Charles and Cole 2006; Morris and Burgh 1954; Webster 2019). As exotic goods from marine environments, *Olivella* and *Haliotis* spp. shell pendants and beads would have been costly to acquire, and they reflect long-distance trade with the Pacific Coast or intervening groups. The production of stone pendants and beads, commonly from chlorite schist and lignite, were less costly to acquire but still entailed manufacturing time that could have been spent on subsistence or childcare. The most readily available beading material would have been juniper seeds, although they were often scorched black, ostensibly to give the appearance of lignite (Webster 2019:147). Such adornment artifacts commonly appear within Basketmaker habitation and burial features across the northern Southwest, although the specific pendant and bead materials varied regionally (Charles and Cole 2006; Morris and Burgh 1954). Multistrand necklaces and feather hair combs are also well represented in Basketmaker rock art (Webster 2019; Figure 7).

Early Basketmaker II period groups generally appear to have been relatively egalitarian, lacking clear evidence of internal social differentiation. Even concepts of gender identity and the division of labor appear to have been fluid in the small-scale autonomous settlements. For example, a female burial at White Dog Cave occurs with an atlatl (Guernsey and Kidder 1921), suggesting a tempered division of subsistence labor during Basketmaker times (*cf.* Haas et al. 2020). Yet, the Basketmaker II period may represent one of accelerating status competition—likely male—through shamanic rituals (Robins and Hays-Gilpin 2000). As mobile farmer-forager societies transitioned from lowland floodwater and sub-irrigation farming, which previously generated group hegemony, the groups appear to have moved toward dry-land farming and sedentism. New social systems developed to solve intergroup tensions and discord associated with growing populations, land tenure, and community integration (Robins and Hays-Gilpin 2000).

For example, between roughly 2.2 and 1.7 cal BP—and expanding during the Basketmaker II–III transition—the previously homogenous, gender-neutral San Juan Anthropomorphic imagery became



**Figure 7.** San Juan Anthropomorphic petroglyphs depicting male individuals with multistrand necklaces from Butler Wash, Utah. (Color online)

highly gendered. Whereas female imagery depicts puberty and emergence, masculine scenes depict large, broad-shouldered male figures with prominent headgear (Webster 2019). These imposing figures may have served to assert dominance over the contributions of women and to integrate nonlocal males into matrilineal communities (Robins and Hays-Gilpin 2000; see Figure 7). Thus, the Basketmaker II period, which persisted for approximately 2.5 millennia, can be characterized as an increasingly agricultural economy with increasing levels of social differentiation along lines of gender and wealth.

### Green June Beetle (*Cotinis mutabilis*)

Understanding the role of beetle jewelry in Basketmaker II society requires an understanding of beetle life history, which would have fundamentally affected jewelry production costs. The jewelry beads were made from the femoral segments of *Cotinis mutabilis*, commonly known as the figeater or green June beetle (Figure 8). A member of the Scarabaeidae family, *Cotinis mutabilis* measures up to 25 mm (1 inch) in length and displays a green to brown backside and an iridescent green to red underbelly (Werner and Olson 1994:72). Although modern-day populations of the insects commonly feast on citrus crops between June and August, they also feed on prickly pear and other sweet fruits and plants of the Southwest (Werner and Olson 1994:72).

Today, the *Cotinis mutabilis* beetle generally occurs at relatively low elevations, from California to Texas and south into Mexico (Goodrich 1966:557). No modern documented examples of *Cotinis mutabilis* are currently known in the San Juan Basin. *Cotinis mutabilis* specimens, however, are documented as far north as Las Vegas, Nevada; Pueblo, Colorado; St. George and Hurricane, Utah (Krell et al. 2015; Symbiota Collections of Arthropods Network 2020); and Cedar City, Utah (Shawn Clark, personal communication 2020). However, their occurrence in Utah seems to reflect a recent range extension from the south (Krell et al. 2015). Accordingly, it appears that Bears Ears National Monument is marginal habitat for *Cotinis mutabilis*. It seems likely that the beetles did not occur in the Bears Ears National Monument region—or that they occurred in low numbers—during the Basketmaker II period. Acquisition of the femoral segments would thus have required intensive collection efforts or material importation.

### Cultural Entomology and the Southwest

In the Southwest, archaeoentomology—the study of archaeological sites through the analysis of insect remains—primarily focuses on pre- or postdepositional processes, insect consumption by humans, and the exploitation of insect residues (Graham 1965; Lesnik 2018; Sutton 1995). Ethnographic data from the Southwest as well as greater North America indicate, however, that insects fulfilled roles beyond techno-economic uses (cf. Liu 2001; Pool and Biscula 2017; Sutton 1995).

Despite prominent depictions of insects in creation stories and on material objects, archaeologists know little about the roles of insects in the Southwest. Comprising 75% of all animal species on earth, insects—or more broadly, arthropods (hereafter, insects)—play an integral role in ecological sustainability and human productivity (Resh and Cardé 2009). As humankind's primary competitor for global



Figure 8. Image of the green June beetle (*Cotinis mutabilis*). (Photo by Tom Mills.)



dominance, we often imbue insects with negative connotations as the vectors of pathogens, parasites, and crop loss (Hill 1996; Kellert 1993; Prokopy and Kogan 2009). This dynamic relationship, as well as similarities in insect–human behavior—and to some degree, appearance—results in ascribing anthropomorphic and mythical qualities to insects. Throughout the world, insects form the framework of human ideology and social structure—from language, ritual, and mythology to recreation and art (Cherry 2002; Hogue 2009; Sutton 1995).

Parallels between insect and human societies create a metaphorical stage upon which to educate, and even intimidate, through traditional mythology (Cherry 2002; Hogue 2009). Anthropomorphized insect characters perform elaborate roles in such mythologies, assisting in the creation of the universe or delivering famine and destruction. Similarly, the human desire for resurrection and rebirth are reflected in insect metamorphoses and life cycles. Emergence and cosmogenic stories are often seen as a metamorphosis of people beginning as nonhuman forms within various underworlds (Hogue 2009; Liu 2001). Navajo creation stories portray one such underworld as inhabited by insect people (Malotki 1997:59; Matthews 1897:63). In Hopi mythology, animal characters, including the locust and the spider, are said to have ascended from the underworld into our current realm (Goldfrank 1948). An anthropomorphized spider character in Hopi legend, known as Kookyangwso’wuuti, or “Spider Woman,” controls crop growth and is depicted as a heroine of those in need (Malotki 1997:59). In death, a Hopi’s “breath,” or soul, that had been deemed evil may be resurrected as a beetle or ant after purification (Walker 1999:396).

Additional mythology from Southwest Puebloan communities includes the creation myth of the Zuni. According to Zuni mythology, a four-legged water strider showed the Zuni people their homeland by positioning its body above the heart and navel of earth and stretching its legs to the solstices (Werness 2000:320). Similarly, a Cochiti Pueblo creation story depicts the scarab beetle, likely in the genus *Eleodes*, as the courier of a bag holding the celestial stars. Disobeying strict orders not to open the bag, the curious scarab haphazardly spilled the stars, resulting in the formation of the Milky Way. The scarab was punished for his curiosity and carelessness with blindness and forever bows his head in shame when approached, as beetles in the in the genus *Eleodes* do today (Benedict 1931; Cherry 2002; Hogue 2009).

Symbolism, through various behaviors and elements of material culture, demonstrates the reverence of insects in Indigenous societies. Considered to possess beauty, ingenuity, vengeance, and determination, insects and their behaviors appear to mimic human morality (Hogue 2009; Klein 2007; Kritsky and Cherry 2000). Insect depictions and symbolism occur throughout the world with considerable antiquity. An engraved Paleolithic bone fragment from Enlène (Montesquieu-Avantès, Ariège, France), dating to 14.0–13.5 ka, provides one of the earliest known depictions of a grasshopper (Malotki 1997:58). An 8.0 ka pictograph from the Cuevas de la Araña (Spider Caves) in eastern Spain depicts an anthropomorphic figure collecting honey as bees fly alongside (Klein 2007). Southwestern rock imagery commonly depicts centipedes, spiders, dragonflies, scorpions, and other abstract depictions of long-bodied six- or eight-legged creatures (Bostwick 2002; Malotki 1997; Schaafsma and Young 2007). Anthropomorphic figures in rock imagery are also depicted with insect traits, such as antennae or multiple legs. Conversely, insects are depicted with human attributes, such as humpbacked flute players (Parsons 1938; Patterson 2020).

Some of the most clearly defined depictions of insects from the Southwest past come from Mimbres ceramic motifs of western New Mexico. An early analysis by Jesse Walter Fewkes indicates that 12% of 733 inventoried Mimbres ceramic vessels depict insect-like motifs (Capinera 1993:222). Insects—including the blowfly, robber fly, dragonfly, cricket, cicada, bee, wasp, butterfly, and moth—are also represented in historic Hopi Kachina ceremonies (Skiles 2008:165). Skiles (2008) suggests that Koshari, one of the sacred clowns who entertain audiences during kachina ceremonies, likely represents the black-and-white-banded alder beetle, *Rosalia funebris*.

### ***Beetles and Adornment in Ethnography***

The global ethnographic and historic records of insect use demonstrate insect incorporation into items of personal adornment. In some instances, living insects may act as adornment, as is the case of the

headlight beetle (*Pyrophorus nyctophanus*) in the West Indies. Early Spanish and historic accounts describe Indigenous women in the Caribbean and Central America tying live luminescent headlight beetles to their toes, ankles, and hair to illuminate their path at night (Hogue 1993:253; Terry 1923:568). In 2006, bejeweled Madagascar hissing cockroach brooches, with short leashes, crawled across the shirts of the American fashion community (Govorushko 2018:147). More commonly, however, the physical remains of insects, primarily those with an iridescence color spectrum, are incorporated into adornment.

Animal iridescence serves many roles in visual communication and predator deterrence (Doucet and Meadows 2009). Insect iridescence derives from the phenomenon of thin-film interference, in which light waves refract through layers of insect chitin (Doucet and Meadows 2009; Rivers 2003). Unlike some other animals, insect iridescence remains vibrant long after death. The relative density of chitin and the sustained iridescent colorization makes insects, or parts thereof, highly desirable as adornment (Rivers 2003). Iridescent dragonflies, butterflies, and beetles are the most commonly utilized insects in historic and modern adornment, with beetle elytra—the hard outer wing covers—being especially favored (Govorushko 2018:147; Rivers 2003).

The aptly named jewel beetle, or metallic wood-boring beetle (from the family Buprestidae), appears in traditional ornaments across southeast Asia, China, Japan, India, Papua New Guinea, and the Amazon Basin (Govorushko 2018:147; Rivers 2003). From ethnographic accounts, we know that the shimmering, emerald iridescent colors of jewel-beetle elytra adorn headdresses and headbands in Papua New Guinea, and they are believed to display and attract wealth and augment sexual appeal. Young Pwo Karen women, part of an ethnolinguistic group of northeast Myanmar and northern Thailand, wear elaborate patterned “singing shawls” with a fringe of beetle elytra and bells at funerals. The sound produced by the movement of the singing shawls is believed to ward off evil and escort the deceased into the afterlife (Leslie 2007:85; Rivers 2003). The Indigenous Shuar of Ecuador and Peru wear the brilliant-colored *Euchroma gigantea* or *Chrysophora chrysochlora* beetle elytra woven with toucan feathers and plant fibers in large, layered ear ornaments that drape down to the shoulders to demonstrate a person’s wealth, mystical power, and well-being (Rivers 2003; Roe 1995; Figure 9).

The textile industry of seventeenth- and eighteenth-century India glimmers with the addition of woven metallic beetle elytra. Vibrant beetle wings adorned exquisite, high-quality sashes, robes, turbans, and silk and were worn by the wealthy and members of royal societies across India. The relatively rare and difficult-to-reproduce blue-velvet color spectrum of beetle elytra elevated the status of those who wore such bejeweled clothing. Beetle adornment made its way to the Western world from the British Raj in India during the nineteenth century. Aristocratic women in the British Isles and Western Europe wore Victorian dresses with stylized flower imagery embroidered with lavish silks, spangles, and emerald beetle wings (Leslie 2007; Rivers 2003). Westerners took so strongly to this beetle adornment that in 1865 a French ball gown incorporated 37 yards of fabric adorned with beetle elytra, butterflies, mother-of-pearl, and spangles (Armstrong 1976). The fashion trend culminated with a performance of *Macbeth* in 1888 at London’s Lyceum Theatre in which Lady Macbeth wore a transfixing green gown with over 1,000 beetle elytra (National Trust Collections 2020).

The foregoing discussion of the cultural significance of insects makes apparent the prominent roles of insects in oral traditions and storytelling as a generalizable phenomenon. Colorful and lustrous insects and insect parts are also commonly used in competitive social environments to signal an individual’s worth. In contemporary Western cultures, such showy status-competition pieces commonly manifest as jewelry made from precious metals and stones but occasionally from iridescent insect parts.

### **Costly Adornment in Small-Scale Human Societies**

Having identified an early agricultural context for the beetle jewelry artifacts and the potential place of insect jewelry in status competition among ethnographic groups, we now explore the role of jewelry in other early agricultural contexts as a frame of reference for the Basketmaker II jewelry artifacts. Dress and adornment offer key insights into identity and interpersonal relations (Bar-Yosef Mayer and Bosch 2019; Matson 2006; Robins and Hays-Gilpin 2000). Found in many Paleolithic sites, adornment demonstrates the early emergence of self-expression in human evolution (Baysal 2019). Beyond aesthetics, adornment is a highly visible means of communicating individual ideology, gender, age, ethic or social



**Figure 9.** Shuar *akiti* (ear ornaments) made from beetle elytra, toucan feathers, and plant fibers. National Museum of the American Indian, Smithsonian Institution (catalog number 18/8740).

affiliation, or situational roles. Rarity or difficulty in raw material procurement and time investment in production often (but not always) attach value to ornaments displaying the hierarchical status/segregation of an individual/group (Bird et al. 2001). Conversely, adornment can provide horizontal cohesion and integration (Gintis et al. 2001). Consequently, costly adornments generally can serve to organize populations into groups at various social scales and along various demographic lines.

Here, we define “costly adornments” as any worn items that are simultaneously showy and expensive in terms of procurement or manufacturing time. Such items lack direct utility in homeostatic pursuits such as subsistence, shelter, clothing, or defense. Whatever the culturally particular meanings of costly adornments in the deep past, it seems undeniable that they were clear and honest signals of one’s access to capital, whether in the form of food, labor, materials, alliances, or mates (Borgerhoff-Mulder et al. 2009; Henrich 2009). In this sense, costly adornments are *honest* markers of status in human societies, because the high cost of production is difficult to fake. Onlookers are essentially assured that the wearer of the jewelry commands sufficient skill or resources to produce or otherwise acquire such nonutilitarian goods (Conolly 2017). Such objects can, in turn, serve as something of a currency for access to material and social resources in social networks. To offer an example from contemporary Western culture, gold and diamonds are showy, rare goods routinely deployed in mating competitions in which competing male suitors use them to honestly signal wealth and commitment to prospective brides. Gold also figures (or figured) prominently in nonmating status competitions as well—think of royal crowns.

Costly adornments can be contrasted with “cheap” adornments, with the recognition that there is a cost continuum between the two. Whereas costly adornments have greater potential to honestly signal exceptional ability or wealth in competitive zero-sum economic situations, cheap adornments perform poorly in such situations (i.e., they are “cheap talk”) and are better suited to signaling shared norms in synergistic, mutually beneficial situations of coordination and collaboration (sensu Cronk and Leech 2012). A modern example of this kind of coordination signaling would be traffic signs. We all agree that we do not want to crash our cars at intersections, so Western culture has devised a relatively inexpensive symbolic system—conspicuous traffic signs and lights that are red to mean “stop” and green to mean “go”—to coordinate our actions.

Such coordination symbolism might characterize the widespread Paleolithic use of ostrich, marine shell, and bone-bead jewelry among Old World foragers as social networking media. In this view, relatively accessible, inexpensive bead jewelry and the symbols inscribed on them would have been part of mutually beneficial resource exchanges among neighboring groups, which would have signaled shared

knowledge of exchange systems designed to smooth over incongruities in the spatiotemporal distribution of subsistence resources (Dutkiewicz et al. 2020; Stewart et al. 2020). Consequently, relatively “cheap” Paleolithic beads may have signaled supergroup membership in an economic system that solved coordination challenges to the mutual benefit of its constituent subgroups (*sensu* Wobst 1977). It may be for this reason that such artifacts are so widespread in the archaeological record of Paleolithic Europe and Africa (Steele et al. 2019; Stewart et al. 2020; Vanhaeren and d’Errico 2006). The use of juniper seed and stone beads made from locally available materials in Basketmaker II culture may have similarly served such coordination-signaling purposes.

In contrast to ostensible coordination signaling in the Paleolithic, competition signaling was evidently rare or absent among those populations. More generally, materially mediated status competitions do not appear to broadly manifest in the archaeological record of forager societies. Rather, extreme status competition and inequality are often considered emergent hallmarks of agricultural and pastoral economies with their attendant surplus food production and storage, as is well documented ethnographically (Borgerhoff-Mulder et al. 2009). Such competitive behaviors tend to manifest archaeologically in the appearance of exotic, showy, or labor-intensive goods, which ostensibly served as honest signals of wealth—whether material, social, or embodied wealth (*sensu* Borgerhoff-Mulder et al. 2009).

The earliest documented uses of metal artifacts tend to have been associated with the earliest agricultural economies, and they tend to be decorative objects, as they are in the Middle East (Garfinkel et al. 2014), Asia (Peterson and Shelach 2012), eastern North America (Ehrhardt 2009; cf. Smith 2006), and the Andes (Aldenderfer et al. 2008). Given this apparent relationship between agricultural production, status competition, and precious metals, it is curious that for much of the Southwest Basketmaker II period—a period defined by emergent agricultural economies—such prestige goods appear to have been absent. Precious metals were, in fact, never part of the social fabric in the known past of the Southwest. Obsidian and turquoise eventually became important in subsequent Puebloan periods but are rare or absent from Basketmaker assemblages.

The apparent absence of prestige goods among early agricultural communities of the Basketmaker periods presents something of a puzzle. Either Basketmaker peoples solved one of the major social challenges of agricultural economies—curtailing status competition and hyper-inequality—in a distinctly egalitarian way and made it work for over 2,000 years, or archaeologists have yet to identify the cultural objects that marked Basketmaker prestige and status.

From a Western perspective, precious metals and certain exotic minerals seem to be obvious indicators of status competition. However, our cross-cultural survey of insect use shows that symbols of wealth and power need not reside in precious metals or minerals. Colorful insects figure prominently as status symbols among a number of global cultures. Similarly, colorful bird feathers can serve the same role. For example, Capriles and colleagues (2021) argue that parrot feathers were important status objects in the Andes of South America. Therefore, it is not metals *per se* that are salient to status competition but rather some of the key properties that metals embody—that is, metal objects are highly visible, whether for their brilliance or luster, and are costly, whether due to rarity of occurrence, distance to raw-material sources, or production labor requirements.

### **Basketmaker II Beetle Artifacts as Prestige Goods**

The two Basketmaker beetle artifacts reported here seem to fit the definition of costly adornments, suggesting that such goods may have served as status symbols. If so, they simply evaded archaeological detection because of their rarity in the cultural system, because of their perishable nature, or because archaeologists failed to recognize the insect parts as cultural artifacts. Even if June beetle parts were recognized as cultural, it is possible that archaeologists would not have recognized them as potential prestige goods given Western biases that tend to associate precious metals and certain minerals with prestige. Yet, this beetle jewelry meets all of the criteria of prestige goods as outlined above. Their iridescence is eye-catching and showy and therefore easily recognizable, particularly when the small insect parts are aggregated into a larger bracelet or necklace. Iridescence is a well-known display strategy in the animal kingdom more generally, particularly among some bird and insect species such as

peacocks and butterflies, respectively, that employ iridescence in mating signals (Wijk et al. 2016). Consequently, iridescence seems to be universally efficacious in attracting attention. In the same way, feather-decorated hair combs (Webster 2019) would have garnered attention for their visual brilliance and elevated position on the heads of status-seeking Basketmaker II individuals.

Beetle jewelry is not only highly visible but also a high-cost object on the Plateau. Current evidence suggests that June beetles did not inhabit the Colorado Plateau in the past (Krell et al. 2015). Even if their range did include the Plateau during the Basketmaker II period, they would have been available for just three months a year, during the adult phase of their life cycle. It furthermore takes many beetles to produce a single piece of macroscopically visible jewelry, yet June beetles likely cannot be harvested en masse on the Colorado Plateau given that it is marginal habitat. These aspects of June beetle geography and life history entail high procurement costs, whether incurred from importation or local procurement for a temporally and quantitatively sparse resource. Likewise, the inclusion of the abalone pendant in the Atlatl Cave necklace would have introduced additional acquisition costs.

The high cost of the Basketmaker II beetle jewelry is also evident in the microcrafting aspect of the objects. The minute scale of the elements that make up the two artifacts deserves some attention and comparison with other ancient and modern-day crafting practices. Necklace construction appears to maximize the visibility of the femora and required deft manipulation at a micro scale. The smaller beads of bone or stone used around the world in human crafting typically measure approximately 2 mm in diameter with proportionately minute perforations to enable stringing. In the modern era, steel needles and fine metal wires remove the difficulty of stringing the tiny beads. In ancient contexts, however, remarkably fine needles of bone or ivory are well known (Blaine and Wendorf 1972). The most obvious example of a readily available and naturally occurring needle that might have been used in stringing the Basketmaker II beetle femora comes from a range of cacti. For example, by attaching the fine yucca cordage to a cactus needle using pitch or other available mastic, the needle might be run painstakingly through the beetle femora. Another category of applicable microcrafting comes from mass production of stone and shell beads, which results in remarkably minute bead diameter and appropriately scaled perforations as small as 0.45 mm (Curcija 2020).

The production of cordage for stringing the beetle parts was also likely nontrivial. Extremely thin cordage would have been required to thread the delicate beetle legs, yet the cordage would have required sufficient uniformity and strength to withstand occasional tugs and jerks when in use. The fine-textured, uniform-diameter yucca fiber cordage used to make the two beetle artifacts would have achieved these performance requirements but at some cost in processing time (Haas 2001; see Figure 1b).

In sum, assembly of the jewelry would likely have required a fair degree of skill, microscale dexterity, and considerable time investment—time that could be spent in more direct fitness pursuits such as hunting, foraging, courting, or parenting. Nonetheless, some Basketmaker II people felt it was worthwhile to invest in the production or trade acquisition of these costly objects. The adornment of beetle jewelry therefore would have constituted an honest signal of an individual's capacity to devote time and resources to “nonessential” pursuits, thereby indexing access to social capital toward whatever particular social end.

Similarly, the occasional use of marine-shell, chlorite schist, and lignite pendants and beads among eastern Basketmaker II populations may have indexed status among individuals and families in those first farming communities. The fact that more readily available juniper seeds were sometimes scorched to look like lignite beads (Webster 2019:147) may even suggest efforts to find inexpensive solutions to produce otherwise costly jewelry in order to compete or subvert aggrandizing behavior. That bead jewelry accompanied Basketmaker individuals to the grave (Morris and Burgh 1954) further suggests the utility of jewelry in kin-based status signaling during funerals. Feather-decorated hair combs may have served a similar role in Basketmaker II society (Webster 2019). Yet, archaeologists may have overlooked such insect and feather adornments as evidence of status competition because, unlike gold or turquoise, such materials rarely play a prominent role in status competition in Western society today.

It is unclear how widespread beetle jewelry would have been among Basketmaker II peoples. On the one hand, the rarity of the objects in the archaeological record suggests a degree of rarity—with use by

an elite minority—in the Basketmaker II population. Supporting this point, no examples of beetle necklaces or femora have been identified among the 5,000 perishable artifacts from southeastern Utah documented by the Cedar Mesa Perishables Project (Laurie Webster, personal communication 2022). On the other hand, the paucity of beetle artifacts may reflect problems of preservation for a perishable artifact class or the failure of archaeologists to recognize insect parts as cultural materials. The reality is probably that both systemic and archaeological processes render Basketmaker beetle jewelry rare objects.

### Summary and Conclusion

This analysis began with a report on two archaeologically unknown beetle-femora jewelry artifacts from Bears Ears National Monument. Contextual information and radiocarbon dates confirm a Basketmaker II period (4.0–1.5 cal ka) association with direct dates of 2.0 cal ka. The unusual and visually striking nature of the iridescent artifacts raised the question of how they may have fit into the social fabric of this early agricultural society. In order to advance a working hypothesis, we reviewed ethnographic and archaeological data on insect and jewelry use among cultures around the world, with particular emphasis on those of the US Southwest. We furthermore considered recent theoretical work in evolutionary ecology, which is well suited to developing hypotheses about intraspecific communication.

The global ethnographic record demonstrates that insects are woven into the fabric of many global cultures, including Western cultures. Their visual prominence and seemingly unusual metamorphosis life cycles have led human societies to use them as symbols of power, wisdom, strength, and immortality. These anthropomorphic projections figure prominently in mythology and symbolism across the globe (Cherry 2002; Hogue 2009; Rivers 2003; Sutton 1995). The selection of *Cotinis mutabilis* for use in Basketmaker II jewelry was undoubtedly culturally and symbolically layered.

The striking metallic colors were clearly part of the attraction to producing these cultural objects. Iridescence is a salient signal across biological taxa, with a number of species relying on iridescence for competitive displays—such as the peacock, which flaunts iridescent tail feathers to prospective mates in competition with other males. Our review of the ethnographic record suggests that iridescent insect parts and feathers serve similar roles in human societies, where they are commonly used to signal status and wealth, such as among the Papua New Guineans and Shuar. These ethnographic patterns therefore led us to consider the possibility that Basketmaker II beetle jewelry was related to status competition.

To further assess the role of beetle jewelry in Basketmaker II culture, we considered the role of jewelry in early agricultural societies elsewhere around the world. We observed that although jewelry was widespread among foragers very early in time, even in Paleolithic Africa and Europe, those jewelry objects tended to be made from relatively accessible, visually inconspicuous materials, including shell and bone. The use of exotic, visually conspicuous materials such as gold, copper, and turquoise tended to occur in early agricultural periods, when they were incorporated into jewelry. We argue that this apparent correlation between agricultural economies and the use of jewelry objects made from rare, visually striking materials reflects increasingly competitive environments fueled by surplus food production, which allowed individuals to accrue wealth at levels previously impossible among mobile foraging economies. As with precious minerals, the iridescent green beetle jewelry; the lustrous marine-shell, lignite, and schist jewelry; and the prominent feathered hair combs of the Basketmaker II people are visually striking, making them effective communication tools. And as with objects made from precious minerals and shell, green beetle jewelry and feathered headdresses would have been difficult to manufacture, making them honest signals of economic capacity or social capital. We therefore conclude that iridescent beetle jewelry and similarly striking objects of Basketmaker II culture reflect efforts to compete on an increasingly competitive socioeconomic landscape, one in which some communities generated food surpluses, and others did not.

More specific details about where the objects fit into the Basketmaker II social fabric remain unclear. Admittedly, the working model we have presented is based on few samples, limiting our understanding of the range of cultural use. This paucity may attest to the limited use of these objects in the past. Sutton (1995:265) observes that insect exoskeletal remains often persist relatively well in the archaeological record. Given this, coupled with the remarkable preservation of Basketmaker II artifacts

found in dry caves and rockshelters, the rarity of such artifacts would seem consistent with a hypothesis of status competition: few members of society could afford to engage in the behavior, thereby leaving few objects to enter the archaeological record.

It is also possible that the use of beetle jewelry was restricted to certain Basketmaker II subgroups, which would further limit the occurrence of beetle jewelry in the archaeological record. Several authors (e.g., Haas 2001; Matson 2006; Robins 1997; Webster and Hays-Gilpin 1994) suggest that groups in the San Juan region constituted a diverse array of ethnic groups, only some of which may have engaged with beetle jewelry and their attendant social behaviors. If so, we might expect only those subgroups in the most productive agricultural landscapes to have participated in this competitive signaling behavior. Alternatively, it is possible that archaeologists have systematically overlooked these artifacts, given that small insect parts are often considered intrusive ecofacts.

Our postulation that *Cotinis mutabilis* jewelry was a product of emerging social inequality, serving as costly signals of status, generates testable predictions for future research. We expect the artifacts to be unevenly distributed within and between Basketmaker II sites. If the divisions were gendered or associated with mating competition, we should expect future research to reveal preferential association with either male or female individuals, perhaps evident in burial practices or rock art (see Figure 7). If, in contrast, the beetle jewelry was primarily associated with economic competition, we would not expect a gender bias but would expect to find beetle jewelry artifacts associated with evidence of agricultural surplus, as indicated by sites in particularly productive agricultural zones or with high frequencies of food-storage structures. Provisionally, it seems that the necklaces pertained more to economic dynamics, given that Basketmaker II rock art depicts both females and males with necklaces (Robins and Hays-Gilpin 2000; Webster 2019). In contrast, headgear seems to have been associated with males, suggesting a greater role in mating competitions. Systematic, quantitative research is needed to further evaluate such economic and gender dynamics.

Whatever the outcome of future research, the Basketmaker II beetle jewelry artifacts described here reveal that early agricultural populations of the San Juan region were among the first in the Southwest to experiment with visually striking, costly jewelry. Comparable goods are currently unknown from preceding Archaic periods. This observation is consistent with ethnographic uses of iridescent insect parts and with archaeological observations in other parts of the world where exotic, showy jewelry often enters human social systems along with surplus food production. Archaeologists may have overlooked Basketmaker II beetle jewelry for so long because of its rarity—both systemic and archaeological (sensu Schiffer 1987)—or a failure to recognize such artifacts as jewelry with visual properties and manufacturing costs that are similar to those of precious minerals. It now seems that early farmers of the Southwest were no exception to the global pattern. With the opportunity for surplus food production came challenges of social competition across multiple domains of interaction, including mating and economic domains at both inter- and intragroup scales. Early agricultural societies engaged with these opportunities and challenges in diverse ways. For at least some Basketmaker II peoples, iridescent beetle jewelry figured into the novel socioeconomic landscape that emerged with food production.

**Acknowledgments.** All authors contributed equally to this article. Jonathan Till and Deborah Westfall at Edge of the Cedars State Park provided access and radiocarbon sampling of the Atlatl Cave beetle adornment. Byl Bryce, Joel Janetski, Julie Lesnik, and Laurie Webster offered thoughts on the manuscript. Luis Flores-Blanco revised the Spanish title and abstract. Last, two anonymous reviewers helped us sharpen the analysis.

**Funding Statement.** Lydia DeHaven, Jared Lundell, Diana Barg, and the Utah Bureau of Land Management provided financial support toward publishing this research.

**Data Availability Statement.** All data used in the current analysis are provided within the text.

**Competing Interests.** The authors declare none.

## References Cited

- Aldenderfer, Mark, Nathan M. Craig, Robert J. Speakman, and Rachel Popelka-Filcoff. 2008. Four-Thousand-Year-Old Gold Artifacts from the Lake Titicaca Basin, Southern Peru. *PNAS* 105:5002–5005. <https://doi.org/10.1073/pnas.071093710>.
- Armstrong, Nancy J. 1976. *Victorian Jewelry*. Macmillan, New York.

- Bar-Yosef Mayer, Daniella E., and Marjolein D. Bosch. 2019. Humans' Earliest Personal Ornaments: An Introduction. *PaleoAnthropology* 2019:19–23. <https://doi.org/10.4207/pa.2019.art121>.
- Baysal, Emma L. 2019. Personal Ornaments in Prehistory: An Exploration of Body Augmentation from the Palaeolithic to the Early Bronze Age. *Archaeological Journal* 177:476–477.
- Bell, Willis H., and Carl K. King. 1944. Methods for the Identification of the Leaf Fibers of Mescal (Agave), Yucca (Yucca), Beargrass (Nolina) and Sotol (Dasylirion). *American Antiquity* 10:150–160.
- Benedict, Ruth. 1931. *Tales of the Cochiti Indians*. Smithsonian Institution Bureau of American Ethnology Bulletin 98. Government Printing Office, Washington, DC.
- Bird, Rebecca Bliege, Eric Alden Smith, and Douglas W. Bird. 2001. The Hunting Handicap: Costly Signaling in Human Foraging Strategies. *Behavioral Ecology and Sociobiology* 50(1):9–19.
- Blaine, Jay C., and Fred Wendorf. 1972. Bone Needle from a Midland Site. *Plains Anthropologist* 17:50–51.
- Borgerhoff-Mulder, Monique, Samuel Bowles, Tom Hertz, Adrian Bell, Jan Beise, Greg Clark, Ila Fazzio, et al. 2009. Intergenerational Wealth Transmission and the Dynamics of Inequality in Small-Scale Societies. *Science* 326:682–688. <https://doi.org/10.1126/science.1178336>.
- Bostwick, Todd W. 2002. *Landscape of the Spirits: Hohokam Rock Art at South Mountain Park*. University of Arizona Press, Tucson.
- Capinera, John L. 1993. Insects in Art and Religion: The American Southwest. *American Entomologist* 39(4):221–229.
- Capriles, José M., Calogero M. Santoro, Richard J. George, Eliana Flores Bedregal, Douglas J. Kennett, Logan Kistler, and Francisco Rothhammer. 2021. Pre-Columbian Transregional Captive Rearing of Amazonian Parrots in the Atacama Desert. *PNAS* 118:e2020020118. <https://doi.org/10.1073/pnas.2020020118>.
- Charles, Mona C., and Sally J. Cole. 2006. Chronology and Cultural Variation in Basketmaker II. *Kiva* 72:167–216.
- Cherry, Ron. 2002. The Functions of Insects in Mythology. *American Entomologist* 48(3):134–136.
- Coltrain, Joan Brenner, Joel C. Janetski, and Shawn W. Carlyle. 2017. The Stable- and Radio-Isotope Chemistry of Western Basketmaker Burials: Implications for Early Puebloan Diets and Origins. *American Antiquity* 72:301–321.
- Conolly, James. 2017. Costly Signalling in Archaeology: Origins, Relevance, Challenges and Prospects. *World Archaeology* 49: 435–445.
- Cronk, Lee, and Beth L. Leech. 2012. *Meeting at Grand Central: Understanding the Social and Evolutionary Roots of Cooperation*. Princeton University Press, Princeton, New Jersey.
- Curcija, Zachary S. 2020. Tiny Perforations in Minute Beads from the Prehistoric Southwest: An Experimental Case for Lithic Minute Microdrills. *Kiva* 86:502–516. <https://doi.org/10.1080/00231940.2020.1832405>.
- Doucet, Stéphanie, and Melissa Meadows. 2009. Iridescence: A Functional Perspective. *Journal of the Royal Society Interface* 6: S115–132. <https://doi.org/10.1098/rsif.2008.0395.focus>.
- Dutkiewicz, Ewa, Gabriele Russo, Saetbyul Lee, and Christian Bentz. 2020. SignBase, a Collection of Geometric Signs on Mobile Objects in the Paleolithic. *Scientific Data* 7(364):1–14.
- Ehrhardt, Kathleen L. 2009. Copper Working Technologies, Contexts of Use, and Social Complexity in the Eastern Woodlands of Native North America. *Journal of World Prehistory* 22: 213–235.
- Emery, Irene. 1966. *The Primary Structures of Fabrics: An Illustrated Classification*. Textile Museum, Washington, DC.
- Garfinkel, Yosef, Florian Klimscha, Sarel Shalev, and Danny Rosenberg. 2014. The Beginning of Metallurgy in the Southern Levant: A Late 6th Millennium Cal BC Copper Awl from Tel Tsaf, Israel. *PLoS ONE* 9(4):e96882.
- Geib, Phil. 2011. *Foragers and Farmers of the Northern Kayenta Region: Excavations along the Navajo Mountain Road*. University of Utah Press, Salt Lake City.
- Gintis, Herbert, Eric A. Smith, and Samuel Bowles. 2001. Costly Signaling and Cooperation. *Journal of Theoretical Biology* 213(1):103–119.
- Goldfrank, Ester S. 1948. The Impact of Situation and Personality on Four Hopi Emergence Myths. *Southwestern Journal on Anthropology* 4:241–262.
- Goodrich, Michael A. 1966. A Revision of the Genus *Cotinis* (Coleoptera: Scarabaeidae). *Annals of the Entomological Society of America* 59:550–568.
- Govorushko, Sergey. 2018. *Human-Insect Interactions*. CRC Press, Boca Raton, Florida.
- Graham, Samuel A. 1965. Entomology: An Aid in Archaeological Studies. In *Contributions of Wetherill Mesa Archaeological Project*, edited by Douglas Osborne, pp. 167–174. Memoirs Number 19. Society for American Archaeology, Salt Lake City, Utah.
- Guernsey, Samuel J., and Alfred Vincent Kidder. 1921. *Basket-Maker Caves of Northeastern Arizona: Report on the Explorations, 1916–1917*. Papers of the Peabody Museum of American Archaeology and Ethnology Vol. 8, No. 2. Harvard University, Cambridge, Massachusetts.
- Haas, Randall. 2001. The Basketmaker II Fiber Industry of Boomerang Shelter, Southeastern Utah: A Synthesis of Cordage Morphology Analysis and Experimentation. *Kiva* 67:167–185.
- Haas, Randall. 2006. The Social Implications of Basketmaker II Cordage Design Distribution. *Kiva* 71:275–298. <https://doi.org/10.1179/kiv.2006.71.3.004>
- Haas, Randall, James Watson, Tammy Buonasera, John Southon, Jennifer C. Chen, Sarah Now, Kevin Smith, Carlos Viviano Llave, Jelmer Eerkens, and Glendon Parker. 2020. Female Hunters of the Early Americas. *Science Advances* 6(45):1–10. <https://doi.org/10.1126/sciadv.abd0310>.
- Haslett, John, and Andrew C. Parnell. 2008. A Simple Monotone Process with Application to Radiocarbon-Dated Depth Chronologies. *Journal of the Royal Statistical Society C* 57:399–418. <https://doi.org/10.1111/j.1467-9876.2008.00623.x>.



- Henrich, Joseph. 2009. The Evolution of Costly Displays, Cooperation and Religion: Credibility Enhancing Displays and Their Implications for Cultural Evolution. *Evolution and Human Behavior* 30:244–260.
- Hill, Dennis S. 1996. *The Economic Importance of Insects*. Campman and Hall, Boca Raton, Florida.
- Hogue, Charles L. 1993. *Latin American Insects and Entomology*. University of California Press, Berkeley.
- Hogue, James N. 2009. Cultural Entomology. In *Encyclopedia of Insects*, edited by Vincent H. Resh and Ring T. Cardé, pp. 239–245. Academic Press, Cambridge.
- Huckell, Bruce B. 1996. The Archaic Prehistory of the North American Southwest. *Journal of World Prehistory* 10:305–216.
- Kellert, Stephen R. 1993. Values and Perceptions of Invertebrates. *Conservation Biology* 7:845–855.
- Kidder, Alfred Vincent, and Samuel J. Guernsey. 1919. *Archaeological Explorations in Northeastern Arizona*. Bureau of American Ethnology Bulletin 65. Government Printing Office, Washington, DC.
- Klein, A. Barrett. 2007. Insects and Humans: A Relationship Recorded in Visual Art. In *Encyclopedia of Human-Animal Relationships*, edited by Marc Bekoff, pp. 92–99. Greenwood Press, London.
- Krell, Frank-Thorsten, Jeff B. Knight, Robert Hammon, Pamela Wheeler, Jeffrey Johns Roberts, and Jason R. Eckberg. 2015. Northern Range Extension of the Figeater Beetle, *Cotinis mutabilis* (Scarabaeidae: Cetoniinae), into Nevada, Utah, and Colorado. *Western North American Naturalist* 75(1):8–13.
- Kritsky, Gene, and Ron H. Cherry. 2000. *Insect Mythology*. Writers Club Press, New York.
- LeBlanc, Steven A., Lori S. Cobb Kreisman, Brian M. Kemp, Francis E. Smiley, Shawn W. Carlyle, Anna N. Dhody, and Thomas Benjamin. 2007. Quids and Aprons: Ancient DNA from Artifacts from the American Southwest. *Journal of Field Archaeology* 32:161–175.
- Leslie, Catherine Amoroso. 2007. *Needlework through History: An Encyclopedia*. Greenwood Press, London.
- Lesnik, Julie J. 2018. *Edible Insects and Human Evolution*. University Press of Florida, Gainesville.
- Liu, Robert K. 2001. The Symbolic Importance of Insects in Jewelry. *Transactions of the American Entomological Society* 127: 167–171.
- Malotki, Ekkehart. 1997. The Dragonfly: A Shamanistic Motif in the Archaic Rock Art of the Palavayu Region in Northern Arizona. *American Indian Rock Art* 23:57–72.
- Martin, Paul S., John B. Rinaldo, Elaine Bluhm, Hugh C. Cutler, Roger Grange Jr. 1952. *Mogollon Cultural Continuity and Change: The Stratigraphic Analysis of Tularosa and Cordova Caves*. Fieldiana 40. Chicago Natural History Museum, Chicago.
- Matson, Richard G. 2006. What Is Basketmaker II? *Kiva* 72:149–166.
- Matthews, Washington. 1897. *Navaho Legends*. American Folklore Society. G. E. Stechert, Salt Lake City, Utah.
- Merrill, William L., Robert J. Hard, Jonathan B. Mabry, Gayle J. Fritz, Karen R. Adams, John R. Roney, and A. C. MacWilliams. 2009. The Diffusion of Maize to the Southwestern United States and Its Impact. *PNAS* 106:21019–21026.
- Morris, Earl H., and Robert F. Burgh. 1954. *BasketMaker II Sites near Durango, Colorado*. Publication 604. Carnegie Institution of Washington, Washington, DC.
- National Trust Collections. 2020. Beetle Wing Dress for Lady Macbeth. Electronic document, <https://www.nationaltrustcollections.org.uk/object/1118839>, accessed May 7, 2020.
- Parsons, Elsie C. 1938. The Humpbacked Flute Player of the Southwest. *American Anthropologist* 40(2):337–338.
- Patterson, Carol. 2020. What can be Learnt from Body Postures and Gestures of Anthropomorphic Figures in Petroglyphs of the Southwest USA. In *Anthropomorphic Images in Rock Art Paintings and Rock Carvings*, edited by Terence Meaden and Herman Bender, pp. 179–199. Archaeopress Publishing Ltd, Oxford.
- Peterson, Christian E., and Gideon Shelach. 2012. Jiangzhai: Social and Economic Organization of a Middle Neolithic Chinese Village. *Journal of Anthropology Archaeology* 31:265–301.
- Pool, Marilen, and Christina Biscula. 2017. Archaeological Adhesives in the American Southwest. Paper presented at the 81st Annual Meeting of the Society for American Archaeology, Vancouver, British Columbia, Canada.
- Prokopy, Ronald, and Marcos Kogan. 2009. Integrated Pest Management. In *Encyclopedia of Insects*, edited by Vincent H. Resh and Ring T. Cardé, pp. 523–528. Academic Press, Cambridge.
- R Core Team. 2022. *R: A Language and Environment for Statistical Computing*. R Foundation for Statistical Computing, Vienna.
- Reimer, Paula J., William E. N. Austin, Edouard Bard, Alex Bayliss, Paul G. Blackwell, Christopher Bronk Ramsey, Martin Butzin, et al. 2020. The IntCal20 Northern Hemisphere Radiocarbon Age Calibration Curve (0–55 cal kBP). *Radiocarbon* 62:725–757. <https://doi.org/10.1017/rdc.2020.41>.
- Resh, Vincent H., and Ring T. Cardé (editors). 2009. *Encyclopedia of Insects*. Academic Press, Cambridge.
- Rivers, Victoria Z. 2003. Emeralds on Wing: Jewel Beetles in Textiles and Adornment. In *Insects in Oral Literature and Traditions*, edited by Élisabeth Motte-Florac and Jacqueline M. C. Thomas, pp. 163–175. Peeters, Dudley, Massachusetts.
- Robins, Michael R. 1997. Modeling the San Juan Basketmaker Socio-Economic Organization: A Preliminary Study in Rock Art and Social Dynamics. In *Early Farmers in the Northern Southwest: Papers on Chronometry, Social Dynamics, and Ecology*, edited by Francis E. Smiley and Michael R. Robins, pp. 73–120. Animas-La Plata Archaeological Project Research Paper No. 7. Northern Arizona University, Flagstaff.
- Robins, Michael R., and Kelley Hays-Gilpin. 2000. The Bird in the Basket: Gender and Social Change in Basketmaker Iconography. In *Foundations of Anasazi Culture: The Basketmaker-Pueblo Transition*, edited by Paul F. Reed, pp. 203–220. University of Utah Press, Salt Lake City.
- Roe, Peter G. 1995 Textiles: The Spider's Loom. In *Arts of the Amazon*, edited by Barbara Braun, pp. 17–121. Thames and Hudson, London and New York.

- Schaafsma, Polly, and M. Jane Young. 2007. Rock Art of the Zuni Region: Cultural-Historical Implications. In *Zuni Origins: Toward a New Synthesis of Southwestern Archaeology*, edited by David A. Gregory and David R. Wilcox, pp. 247–269. University of Arizona Press, Tucson.
- Schiffer, Michael B. 1987. *Formation Processes of the Archaeological Record*. University of New Mexico Press, Albuquerque.
- Skiles, Durward D. 2008. Is the Banded Alder Beetle *Rosalia funebris* Motschulsky (Coleoptera: Cerambycidae) the Model for an Ancient Hopi Clown. *Coleopterists Bulletin* 62(1):165–167.
- Smiley, Francis E. 1997a. Toward Chronometric Resolution for Early Agriculture in the Northern Southwest. In *Early Farmers in the Northern Southwest: Papers on Chronometry, Social Dynamics, and Ecology*, edited by Francis E. Smiley and Michael R. Robins, pp. 13–42. Animas-La Plata Archaeological Project Research Paper No. 7. Northern Arizona University, Flagstaff.
- Smiley, Francis E. 1997b. Regional Packing, Group Dynamics, and the Diffusion of Innovation. In *Early Farmers in the Northern Southwest: Papers on Chronometry, Social Dynamics, and Ecology*, edited by Francis E. Smiley and Michael R. Robins, pp. 59–72. Animas-La Plata Archaeological Project Research Paper No. 7. Northern Arizona University, Flagstaff.
- Smiley, Francis E. 2002. The First Farmers: The White Dog and Lolomai Phases. In *Prehistoric Culture Change on the Colorado Plateau: Ten Thousand Years on Black Mesa*, edited by Shirley Powell and Francis E. Smiley, pp. 37–65. University of Arizona Press, Tucson.
- Smiley, Francis E., and Michael R. Robins. 2005. Help for the Looted Rockshelters of the Colorado Plateau in a New Century of Archaeology: New Basketmaker II Research on the Great Comb Ridge. In *The Colorado Plateau II*, edited by Charles van Riper III and David J. Matson, pp. 319–332. University of Arizona Press, Tucson.
- Smiley, Francis E., and Susan G. Smiley. 2017. Corn Comes to Grand Canyon: Preformative Farmers on the Central Colorado Plateau. In *The Archaeology of Grand Canyon: Ancient Peoples, Ancient Places*, edited by Francis E. Smiley, Christian E. Downum, and Susan G. Smiley, pp. 61–88. Grand Canyon Association, Grand Canyon Village, Arizona.
- Smith, Bruce D. 2001. Low-Level Food Production. *Journal of Archaeological Research* 9:1–43.
- Smith, Cameron. 2006. Formation Processes of a Lower Columbia River Plankhouse Site. In *Household Archaeology on the Northwest Coast*, edited by Elizabeth A. Sobel, D. Ann Trieu Gahr, and Kenneth M. Ames, pp. 233–269. International Monographs in Prehistory Archaeological Series 16. Berghahn Books, Oxford.
- Steele, Teresa E., Esteban Álvarez-Fernandez, and Emily Hallett-Desguez. 2019. A Review of Shells as Personal Ornamentation during the African Middle Stone Age. *PaleoAnthropology* 2019:24–51.
- Stewart, Brian A., Yuchao Zhao, Peter J. Mitchell, Genevieve Dewar, James D. Gleason, and Joel D. Blum. 2020. Ostrich Eggshell Bead Strontium Isotopes Reveal Persistent Macroscale Social Networking across Late Quaternary Southern Africa. *PNAS* 117:6453–6462.
- Sutton, Mark Q. 1995. Archaeological Aspects of Insect Use. *Journal of Archaeological Method and Theory* 2:253–298.
- Symbiota Collections of Arthropods Network. 2020. *Cotinis mutabilis* Distribution Information. Electronic document. <https://scan-bugs.org/portal>, accessed April 5, 2020.
- Terry, T. Philip. 1923. *Terry's Guide to Mexico: The New Standard Guidebook to the Mexican Republic*. Houghton Mifflin, Boston.
- Vanhaeren, Marian, and Francesco d'Errico. 2006. Aurignacian Ethno-Linguistic Geography of Europe Revealed by Personal Ornaments. *Journal of Archaeological Science* 33:1105–1128.
- Walker, William H. 1999. Ritual, Life Histories, and the Afterlives of People and Things. *Journal of the Southwest* 41:383–405.
- Webster, Laurie D. 2019. Interpreting San Juan Anthropomorphic Style Rock Art through the Lens of Museum Collections. In *Rock Art: A Vision of a Vanishing Cultural Landscape*, edited by Jonathan Bailey, pp. 145–155. Johnson Books, Denver, Colorado.
- Webster, Laurie D., and Kelley Hays-Gilpin. 1994. New Trails for Old Shoes: Sandals, Textiles, and Baskets in Basketmaker II Culture. *Kiva* 64:313–327.
- Werner, Floyd, and Carl Olson. 1994 *Learning About and Living with Insects of the Southwest: How to Identify Helpful, Harmful and Venomous Insects*. Da Capo Press, Cambridge, Massachusetts.
- Werness, Hope B. 2000. *The Continuum Encyclopedia of Native Art: Worldview, Symbolism, and Culture*. Continuum International Publishing Group, New York.
- Wijk, Sonia Van, Audrey Bourret, Marc Bélisle, Dany Garant, and Fanie Pelletier. 2016. The Influence of Iridescent Coloration Directionality on Male Tree Swallows' Reproductive Success at Different Breeding Densities. *Behavioral Ecology and Sociobiology* 70:1557–1159. <https://doi.org/10.1007/s00265-016-2164-5>.
- Wills, Wirt H. 1988. *Early Prehistoric Agriculture in the American Southwest*. School of American Research Press, Santa Fe, New Mexico.
- Wobst, H. Martin. 1977. Stylistic Behavior and Information Exchange. In *For the Director: Research Essays in Honor of James B. Griffin*, edited by Charles E. Cleland, pp. 317–342. University of Michigan Press, Ann Arbor.

**Cite this article:** Terlep, Michael L., Francis E. Smiley, and Randall Haas. 2023. Iridescent Beetle Adornments Suggest Incipient Status Competition among the Earliest Horticulturalists in Bears Ears National Monument. *American Antiquity* 88(1):2–19. <https://doi.org/10.1017/aaq.2022.96>.